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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/820,079	03/28/2001	Grant Kloster	42390P11026	4031

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EXAMINER

MAGEE, THOMAS J

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 01/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/820,079

Applicant(s)

KLOSTER ET AL.

Examiner

Thomas J. Magee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 November 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 and 16-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 16-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Cancellations

1. Applicant's cancellation of Claim 15 in Letter No. 14 of November 13, 2002 is acknowledged. Claims 1 – 14 and 16 – 20 are active and still pending.

Claim Rejections – 35 U.S.C. 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 2, and 5 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US 6,291,887 B1) in view of Ahn (US 2002/0090806 A1).

4. Regarding Claim 1, Wang et al. disclose (Col. 12, lines 20 – 32) a structure formed on a substrate with a first low k dielectric layer (diffusion barrier layer) and a nitride layer (etch stop layer) deposited on top, covered by another dielectric layer (ILD layer).

Although Wang et al. do not disclose the effective dielectric constant of the stacked structure, the structure inherently possesses an effective dielectric constant less than about three since a nitride layer is incorporated with two low k layers, each having dielectric constants less than three.

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5. Regarding Claim 2, Wang et al. do not explicitly disclose a specific thickness for the diffusion barrier, but the recited thickness in the range, "one monolayer to 2500 Angstroms" is consistent with Wang. However, Ahn et al. disclose (page 5, 1st col., lines 34 – 36) a similar structure with a thickness of about 2,000 to 15,000 Angstroms. It would have been obvious to one having ordinary skill in the art at the time of the invention to form to utilize a layer having the claimed thickness, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233. In re Dailey, 93 USPQ 47 (CCPA 1966), the court held that changes in size and shape of parts of an invention, in the absence of an unexpected result, involves only routine skill in the art.

6. Regarding Claims 3 and 4, Wang et al. disclose (Col. 8, lines 16 – 21; lines 44 – 46) that the first (diffusion barrier) layer is a polymer (organic) and the etch stop layer is nitride (inorganic).

7. Regarding Claims 5 and 6, Wang et al. do not disclose an inorganic/organic stacking sequence from the substrate. In contrast, Ahn disclose (page 5, 1st col., lines 32 – 33; 37 - 42) that the first dielectric layer is inorganic (oxide) and the second (etch-stop) layer is organic (polymer) in composition. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include Ahn in Wang et al. to obtain an inorganic/organic layer stacking sequence to effectively block diffusion from the substrate.

8. Regarding Claims 7 and 8, Wang et al. do not disclose the presence of a contact trace disposed within the substrate. However, Ahn discloses (page 5, 1st col., lines 12 – 25) the presence of a contact region (trace)(52) and a contact (80) extending through the dielectric layers (55,56,57) and making an electrical connection with the trace (See Figures 12 and 13). Although Ahn does not disclose a “single” damascene structure for the contact, a dual (or T-shaped) damascene structure is formed. The difference between a single and a dual damascene involves only a change in shape and a continuous etch through the layers for the single, whereas the dual requires two etch steps. Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to alter the “shape” of the contact to produce a single damascene structure. Consistent with rulings of the court, changes in the size and shape of parts of an invention, in the absence of an unexpected result, involves only routine skill in the art.

9. Claims 9 –14 and 16 – 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ahn in view of Wang et al.

10. Regarding Claims 9 and 10, Ahn discloses (page 5, lines 12 – 25; 34 – 36) a structure containing a planar metal conducting trace within the substrate, a first (diffusion layer) insulating layer, and a second insulating layer (etch stop). Further Ahn discloses that the composition of the barrier layer and etch stop layer can be independently selected from organic or inorganic sources. Ahn does not disclose the presence of an overlying ILD layer, but Wang et al. disclose a similar structure with an ILD layer deposited

on top of the second layer. Hence, it would have been obvious to include Wang et al. in Ahn to produce the overlying ILD layer.

11. Regarding Claim 11, Ahn discloses that the thickness of the diffusion barrier layer is between 2,000 and 15,000 Angstroms, which is well within the thickness recited (2,500 Angstroms) in the instant application.

12. Regarding Claims 12 –14, neither Wang et al. or Ahn disclose the effective dielectric constants for the stacked diffusion barrier/etch stop/ILD layer sequence. However, as discussed earlier, it would be inherently obvious that an effective dielectric constant in the range, 2.6 to 2.8, could be obtained since the layer sequence includes a nitride layer and two low k layers with dielectric constants less than three.

13. Regarding Claims 16 – 18, Ahn discloses a structure containing a first dielectric layer (silicon oxide)(inorganic), a second dielectric layer (parylene, polyimides, polymers) (organic) and a damascene article in contact with the substrate and dielectric layers. Ahn does not disclose an overlying ILD layer. However, Wang et al. do disclose an ILD layer. It would have been obvious at the time of the invention to one of ordinary skill in the art to add Wang et al. to Ahn to obtain an ILD layer atop the two layer sequence and containing the damascene structure.

14. Regarding Claims 19 and 20, Ahn does not disclose the values of dielectric constant for the second dielectric layer. However, these are routinely available in handbooks and it would be trivial and obvious for one of ordinary skill in the art to select materials from

the range of organic materials disclosed by Ahn, exhibiting dielectric constants in the approximate range, 2.0 to 2.8.

Response to Arguments

15. Applicant's arguments in Letter No. 13 of November 13, 2002 with respect to Claims 1 – 14 and 16 – 20 have been carefully considered but have not been found to be persuasive. Arguments of Applicant appear to be predicated on the presence of a diffusion barrier layer and whether a dielectric is an effective barrier for diffusion. The low k materials in the reference are indeed good barriers for diffusion of a variety of impurities, particularly when the surfaces are sealed. Applicant is attempting to expand the limitations of the claims by inferring that there is language within the claims reciting that the materials should also be barriers for Cu diffusion. There is no such limitation in the claims. Therefore, the rejections by Examiner are maintained.

Conclusions

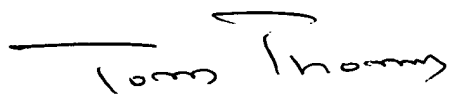
16. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be

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calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to **Thomas Magee**, whose telephone number is **(703) 305 5396**. The Examiner can normally be reached on Monday through Friday from 8:30AM to 5:00PM (EST). If attempts to reach the Examiner by telephone are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The fax number for the organization where this application or proceeding is assigned is **(703) 308-7722**.

Thomas Magee
January 16, 2003


TOM THOMAS
SUPERVISORY PATENT EXAMINER
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